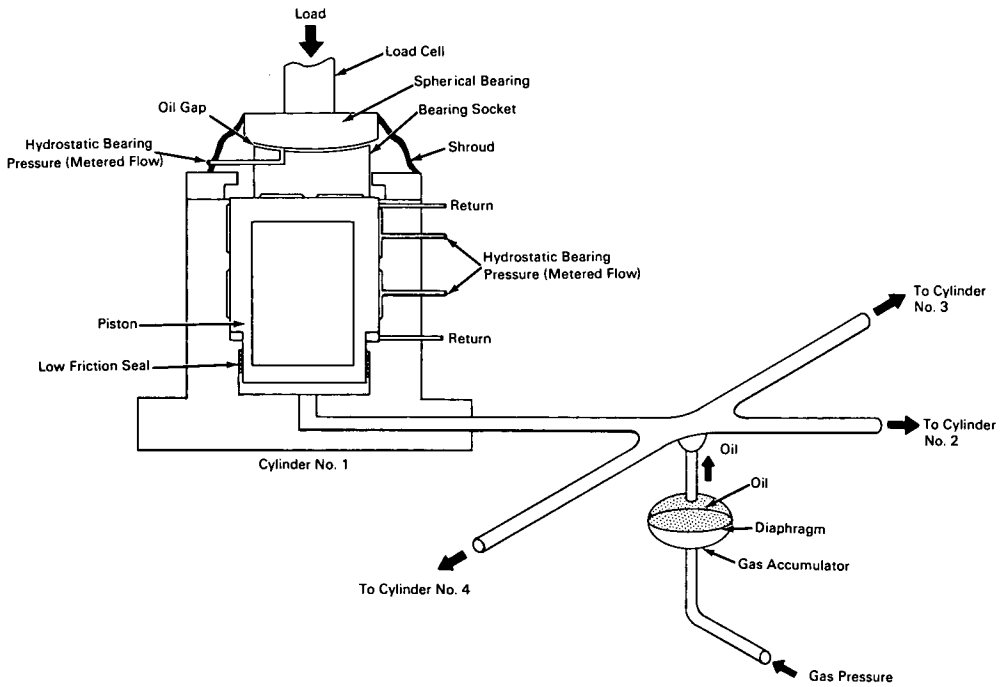
NASA TECH BRIEF

Nonresonant Support Facilitates Vibration Testing of Structures



The problem: Providing a nonresonant support that will allow six degrees of freedom of motion of a large structure subjected to vibration testing. A primary purpose of the support is to enable the accurate determination of vibration frequencies and longitudinal mode shapes of large rocket systems.

The solution: A four-point support system utilizing compressible and incompressible fluids to balance out natural frequencies in the support and thereby prevent mechanical coupling of the support and structure under test.

How it's done: The structure to be tested is mounted on the four load cells of the essentially frictionless support system (only one of the four cylinders of the system is shown in the illustration). When vibration loads are applied to the structure, its motion is allowed six degrees of freedom by the support system. Complete freedom of horizontal motion is allowed by translation of the bearing socket on the upper surface of each of the four pistons. The retarding force for this motion is due to viscous damping by the hydrostatic pressure of the oil in the gap between the bearing socket and the surface of the piston. Rotational freedom is due to the freedom of rotation of

(continued overleaf)

the spherical bearing in the socket and horizontal and vertical motions of the socket and piston, respectively. There are two types of vertical motion allowed at each point of support. The first type is due to flow of oil from one piston to another in such a manner that one piston rises as the opposite one falls. This motion is retarded only by the viscous damping of oil flow in the piping and oil gaps. The second type of vertical motion occurs when all pistons are constrained to translate in the same direction. The retarding force for this motion is controlled by adjusting the gas volume in the accumulator so that the resonant frequency of the support system will not couple with any test vibration frequency, unless it is desired to use the support system to provide a resonant condition when testing for longitudinal modes.

Note: Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama, 35812
Reference: B65-10039

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

Source: The Boeing Company under contract to Marshall Space Flight Center (M-FS-224)